WHAT IS CLAIMED IS:

1 1.   A picture composing apparatus comprising:

2   a plurality of image pickup means;

3   image pickup situation detecting means for detecting

4 an image pickup situation of said image pickup means;

5   first projecting means for projecting a plurality of

6 images taken by said image pickup means onto a projection

7 section in accordance with the image pickup situation

8 detected by said image pickup situation detecting means to

9 generate a plurality of first projected images;

10   second projecting means for projecting said plurality of

11 first projected images to a three-dimensional projection

12 model to generate a second projected image;

13   virtual image pickup means for virtually picking up

14 said second projected image;

15   three-dimensional projection model determining means

16 for determining a position of said three-dimensional

17 projection model and a shape thereof; and

18   pickup situation determining means for determining an

19 image pickup situation of said virtual image pickup means,

20   said second projected image being picked up by said

21 virtual image pickup means in the image pickup situation

22 determined by said pickup situation determining means to

23   combine the plurality of images taken by said plurality of

24   image pickup means.

1   2.   The picture composing apparatus according to claim 1,

2   wherein said image pickup situation detecting means

3   previously detects at least one of a position, posture and

4   image pickup characteristic of said image pickup means with

5   respect to said projection section.

1   3.   The picture composing apparatus according to claim 1,

2   wherein said first projecting means projects points on the

3   images taken by said image pickup means to said projection

4   section through the use of a transformation matrix obtained

5   by associating a plurality of points on the taken images with

6   a plurality of points on said projection section.

1   4.   The picture composing apparatus according to claim 1,

2   wherein said projection section is substantially a plane.

1   5.   The picture composing apparatus according to claim 1,

2   wherein said three-dimensional projection model is a

3   spherical surface.

1   6.   The picture composing apparatus according to claim 1,

2   wherein said three-dimensional projection model is a

3   combination of a plurality of surfaces different in shape from

4   each other.

1   7.   The picture composing apparatus according to claim 6,

2   wherein said three-dimensional projection model is a

3   combination of a plane and a cylinder, and when said second

4   projecting means conducts the projection to said three-

5   dimensional projection model, a distant place is projected to

6   said cylinder and the other place is projected to said plane

7   and said virtual image pickup means picks up the projected

8   image   .

1   8.   The picture composing apparatus according to claim 6,

2   wherein said plurality of surfaces different in shape are

3   combined so that a joint therebetween does not stand out.

1   9.   The picture composing apparatus according to claim 6,

2   wherein said three-dimensional projection model is a

3   combination of a sphere and a cylinder, and when said second

4   projecting means conducts the projection to said three-

5   dimensional projection model, a distant place is projected to

6   said cylinder and the other place is projected to said sphere

7   and said virtual image pickup means picks up the projected

8   image.

1   10.   The picture composing apparatus according to claim 8,

2   wherein said three-dimensional projection model is a

3   combination of three types of surfaces of a cylinder, a plane

4   and a curved surface establishing smooth boundary between

5   said cylinder and said plane.

1   11.   The picture composing apparatus according to claim 1,

2   wherein a line segment on the image taken by said image

3   pickup means is converted into a straight line on a composite

4   picture.

1   12.   The picture composing apparatus according to claim 1,

2   wherein said plurality of image pickup means are mounted

3   on a motor vehicle, and motor vehicle running direction

4   detecting means is further provided to detect a running

5   direction of said motor vehicle.

1   13.   The picture composing apparatus according to claim 12,

2   wherein a position of a viewing point of said virtual image

3   pickup means is set on a straight line passing through a

4   projection center of said second projecting means in parallel

5   with the running direction of said motor vehicle.

1   14.   The picture composing apparatus according to claim 12,

2   wherein a line segment representative of the running

3   direction of said motor vehicle is converted into a straight

4   line on   a composite picture.

1   15.   The picture composing apparatus according to claim 1,

2   wherein said plurality of image pickup means are mounted

3   on a motor vehicle, and motor vehicle body position detecting

4   means is further provided to detect a body position of said

5   motor vehicle.

1   16.   The picture composing apparatus according to claim 15,

2   wherein a position of a viewing point of said virtual image

3   pickup means is set on a plane passing through an image

4   obtained by plane-projecting an end portion of said body of

5   said motor vehicle and a projection center of said second

6   projecting means.

1   17.   The picture composing apparatus according to claim 11,

2   wherein said image pickup means is mounted on a rear end

3   portion of a motor vehicle, and rear end portion of said motor

4   vehicle is converted into a straight line on a composite

5   picture.

1   18.   The picture composing apparatus according to claim 11,

2   wherein said image pickup means is mounted on a side

3   portion of a motor vehicle, and said side portion of said motor

4   vehicle is converted into a straight line on a composite

5   picture.

1   19.   The picture composing apparatus according to claim 11,

2   wherein said image pickup means is mounted on a side

3   portion of a motor vehicle, and a center line of a lane adjacent

4   to a lane said motor vehicle is running on is converted into a

5   straight line on a composite picture.

1   20.   The picture composing apparatus according to claim 11,

2   wherein said image pickup means is mounted on a rear

3   portion of a motor vehicle, and a center line of a road

4   perpendicular to a road said motor vehicle is running on is

5   converted into a straight line on a composite picture.

1   21.   The picture composing apparatus according to claim 11,

2   wherein said image pickup means is mounted on a front

3   portion of a motor vehicle, and a center line of a road

4   perpendicular to a road said motor vehicle is running on is

5   converted into a straight line on a composite picture.

1   22.   A picture composing apparatus comprising:

2   a plurality of image pickup means;

3   image pickup situation detecting means for detecting

4   an image pickup situation of said image pickup means;

5   first projecting means for projecting a plurality of

6   images taken by said image pickup means onto a projection

7   surface in accordance with the image pickup situation

8   detected by said image pickup situation detecting means to

9   generate a plurality of first projected images;

10   second projecting means for projecting the plurality of

11   first projected images to a spherical surface to generate a

12   second projected image; and

13   converting means for spreading the second projected

14   image on a plane round one point on said spherical surface.

1   23.   A picture composing method comprising:

2   an image pickup step of picking up a plurality of

3   images;

4   an image pickup situation detecting step of detecting an

5   image pickup situation in said image pickup step;

6   a first projecting step of projecting a plurality of images

7   picked up to a projection section in accordance with the image

8   pickup situation detected in said image pickup situation

9   detecting step to generate a plurality of first projected

10   images;

11   a second projecting step of projecting the plurality of

12   first projected images to a three-dimensional projection

13   model to generate a second projected image;

14   a virtual image pickup step of virtually picking up the

15   second projected image;

16   a three-dimensional projection model determining step

17   of determining a position of said three-dimensional projection

18   model and a shape thereof; and

19   an image pickup situation determining step of

20   determining the image pickup situation in said virtual image

21   pickup step,

22   the second projected image being picked up in said

23   virtual image pickup step in the projection situation

24   determined in said image pickup situation determining step

25   to combine the plurality of images taken in said image pickup

26   step.

1   24.   A picture composing method according to claim 23,

2   further comprising a step of sending signal information from

3   motor vehicle running direction detecting means, which

4   detects a running direction of a motor vehicle, to image

5   pickup situation determining means used for said image

6   pickup situation determining step.

1   25.   A picture composing method according to claim 23,

2   further comprising a step of sending signal information from

3   motor vehicle body position detecting means, which detects a

4   body position of a motor vehicle, to image pickup situation

5   determining means used for said image pickup situation

6   determining step.

1   26.   A picture composing method comprising:

2   an image pickup step of picking up a plurality of

3   images;

4   an image pickup situation detecting step of detecting an

5   image pickup situation in said image pickup step;

6   a first projecting step of projecting a plurality of images,

7   picked up in said image pickup step, to a projection section in

8   accordance with the image pickup situation detected in the

9   image pickup situation detecting step, to generate a plurality

10   of first projected images;

11   a second projecting step of projecting the plurality of

12   first projected images to a spherical surface to generate a

13   second projected image;

14   a plane spreading step of spreading the second

15   projected image on a plane round one point on said spherical

16   surface; and

17   a spherical surface position determining step of

18   determining a position of said spherical surface,

19   a plurality of images obtained in said plane spreading

20   step are combined to produce a composite picture.

1   27.   A picture displaying apparatus comprising:

2   a plurality of image pickup means;

3   image pickup situation detecting means for detecting

4   an image pickup situation of said image pickup means;

5   first projecting means for projecting a plurality of

6   images taken by said image pickup means onto a projection

7   section in accordance with the image pickup situation

8   detected by said image pickup situation detecting means to

9   generate a plurality of first projected images;

10   second projecting means for projecting the plurality of

11   first projected images to a three-dimensional projection

12   model to generate a second projected image;

13   virtual image pickup means for virtually picking up the

14   second projected image;

15   three-dimensional projection model determining means

16   for determining a position of said three-dimensional

17   projection model and a shape thereof;

18   image pickup situation determining means for

19   determining an image pickup situation of said virtual image

20   pickup means;

21   display means for displaying a picture; and

22   display data conversion control means for converting a

23   picture to be displayed into data adaptable to said display

24   means,

25   the second projected image being picked up by said

26   virtual image pickup means in the image pickup situation

27   determined by said image pickup situation determining

28   means to combine the plurality of images taken by said

29   plurality of image pickup means to produce a composite

30   picture and said composite picture being converted by said

31 display data conversion control means into data adaptable to

32 said display means.

1 28. A picture acquiring/warning apparatus comprising:

2 a plurality of image pickup means;

3 image pickup situation detecting means for detecting

4 an image pickup situation of said image pickup means;

5 first projecting means for projecting a plurality of

6 images taken by said image pickup means onto a projection

7 section in accordance with the image pickup situation

8 detected by said image pickup situation detecting means to

9 generate a plurality of first projected images;

10 second projecting means for projecting the plurality of

11 first projected images to a three-dimensional projection

12 model to generate a second projected image;

13 virtual image pickup means for virtually picking up the

14 second projected image;

15 three-dimensional projection model determining means

16 for determining a position of said three-dimensional

17 projection model and a shape thereof;

18 image pickup situation determining means for

19 determining an image pickup situation of said virtual image

20 pickup means;

21   detecting means for detecting an approaching situation

22   of an object; and

23   warning means for issuing arbitrary warning

24   information when the object approaching situation detected

25   by said detecting means reaches a predetermined object

26   approaching situation.

1   29.   A motor vehicle position recognition/decision apparatus

2   comprising:

3   a plurality of image pickup means mounted on a motor

4   vehicle;

5   image pickup situation detecting means for detecting

6   an image pickup situation of said image pickup means;

7   first projecting means for projecting a plurality of

8   images taken by said image pickup means onto a projection

9   section in accordance with the image pickup situation

10   detected by said image pickup situation detecting means to

11   generate a plurality of first projected images;

12   second projecting means for projecting the plurality of

13   first projected images to a three-dimensional projection

14   model to generate a second projected image;

15   virtual image pickup means for virtually picking up the

16   second projected image;

17   three-dimensional projection model determining means

18   for determining a position of said three-dimensional

19   projection model and a shape thereof;

20   image pickup situation determining means for

21   determining an image pickup situation of said virtual image

22   pickup means;

23   image detecting means for, when at least one of said

24   plurality of image pickup means is backward image pickup

25   means placed on a rear side of said motor vehicle, detecting

26   an image of an arbitrary object from images taken by said

27   backward image pickup means, images obtained by

28   projecting the taken image to said three-dimensional

29   projection mode or a picture obtained by combining the taken

30   images in said virtual image pickup means;

31   recognizing means for recognizing a positional

32   relationship between the image detected by said image

33   detecting means and an image of said motor vehicle; and

34   decision means for making a decision on a positional

35   difference between said motor vehicle and said object on the

36   basis of the positional relationship recognized by said

37   recognizing means.